



HYDRA – Future Perspectives

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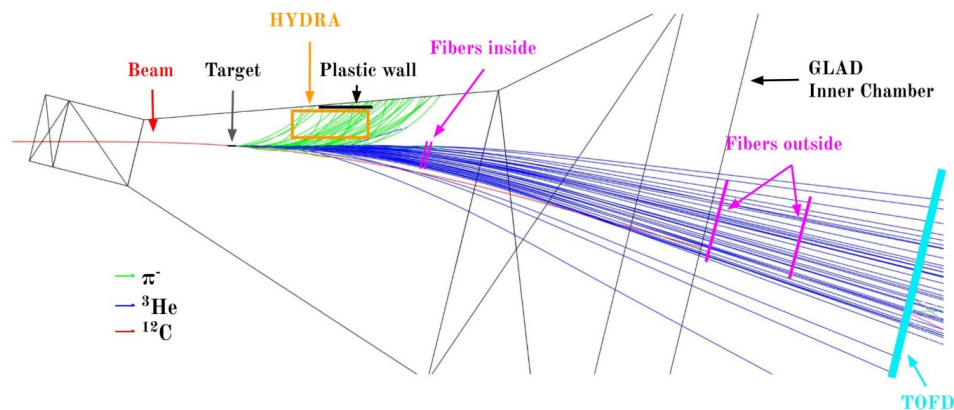
R³B Collaboration meeting
November 16th, 2022

Experimental setup

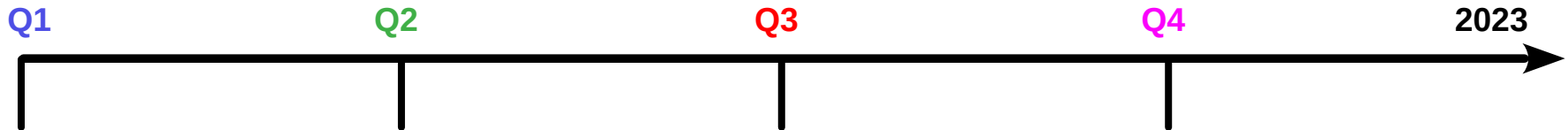
Decay pion: TPC + Plastic wall (trigger)

Recoil ions (mainly ^3He):

- Outside GLAD -
TOFD
4 large-area fibers
 - 50x50 cm², 1 mm thickness
 - readout MAPMTs + KILOM2
- **Inside GLAD - 4 new small-size fibers**
 - 15x15 cm², 1 mm thickness
 - two (x,y) positions
 - based on design of existing detectors
 - SiPMs + **readout electronics – do be decided**
(single channel readout trb3?)
 - **production at GSI / TUDa – to be discussed**

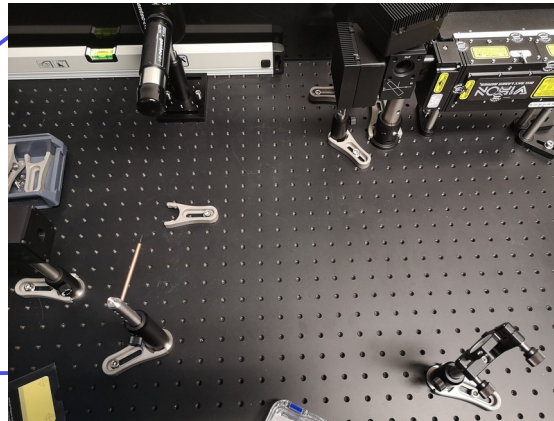
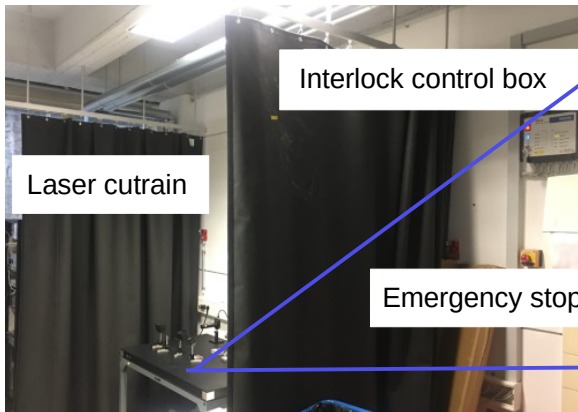


TPC test measurements

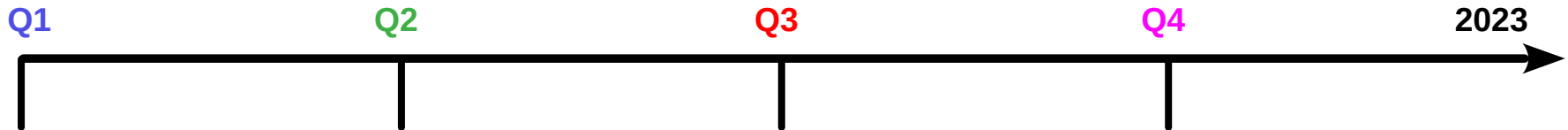


Cosmic measurements & Laser validation (TUDa)

dedicated laser laboratory at TUDa

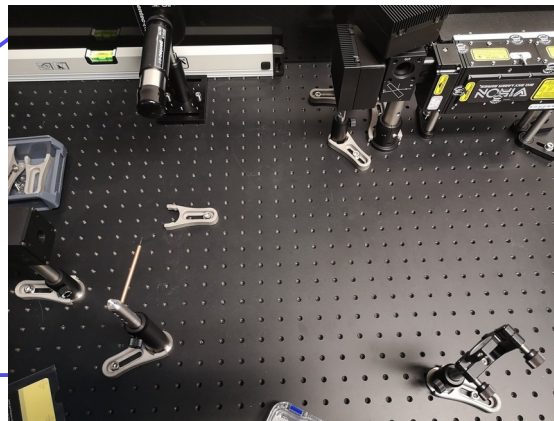
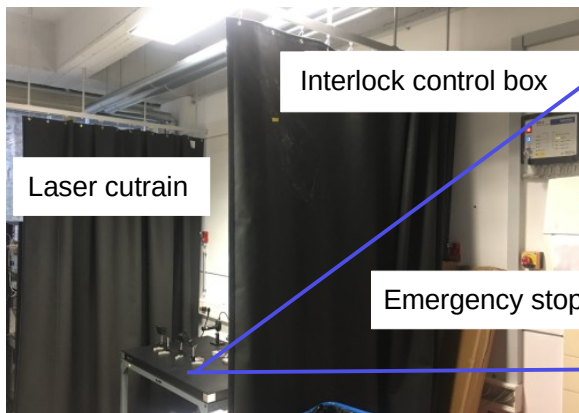


TPC test measurements



Cosmic measurements & Laser validation (TUDa)

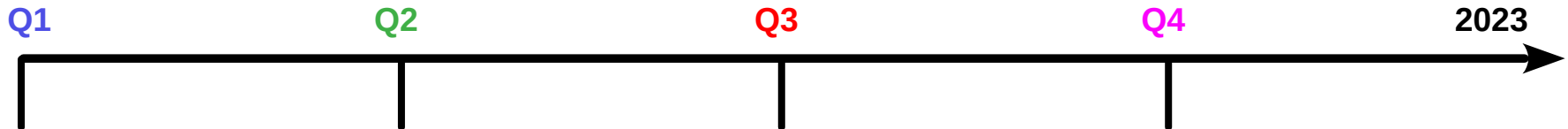
dedicated laser laboratory at TUDa



In-GLAD validation w/ laser

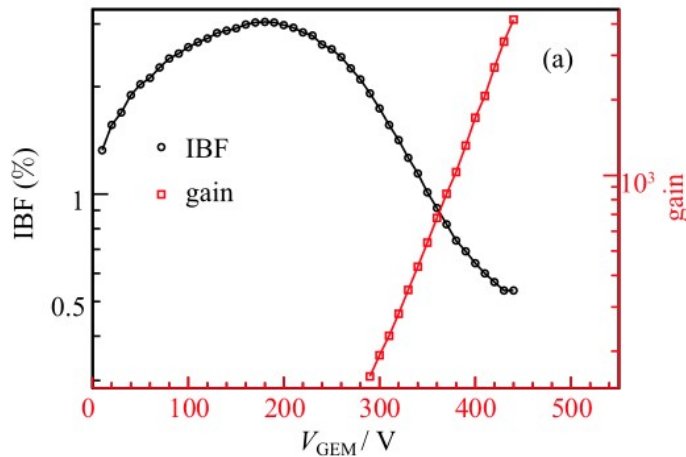
- non-homogenous magnetic-field
- laser-induced reference tracks as benchmark (Q1/Q2, if possible)

TPC test measurements



Measurement of ion-back flow (IBF)

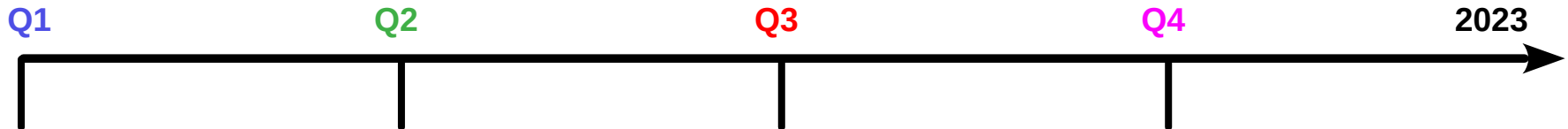
A previous measurement using ^{55}Fe X-ray source demonstrated that combination of micromegas and GEM reduces IBF



Zhang *et al.*, CPC 41 (2017)

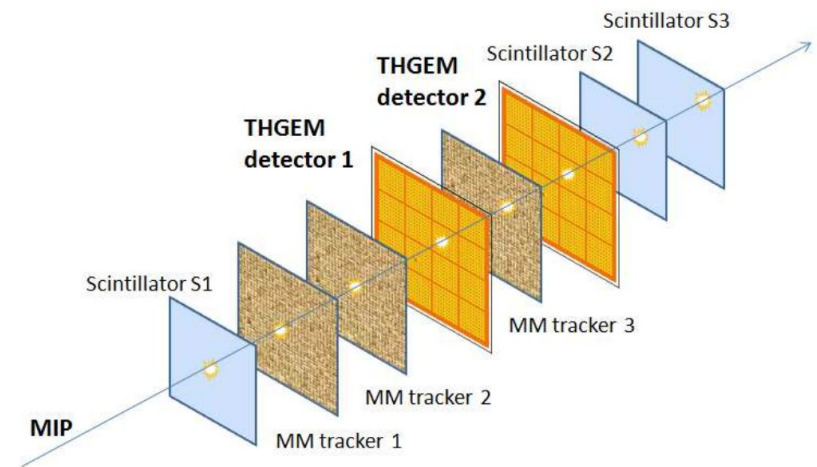
- For HYDRA prototype:
 - IBF is expected to be $< 1\%$
 - space charge distortion of drift-field $\Delta E/E < 0.5\%$
- To be validated and quantified:
 - **'PANDA-BOX' at GSI as X-ray source**

TPC test measurements



In-beam validation: HYDRA TPC

- CERN SPS RD51 beam-line
 - dedicated test-beam setup for detectors
 - high-energy pions (MIP)
- HYDRA prototype at the end of the beam-line
 - together with the plastic wall (trigger)
 - continuous electronics (VMM3)
- Alternatively, beam-time request at a different facility with proton elastic scattering



Bressler *et al.*, JINST 8 (2013)

Full HYDRA TPC

Prototype:

- proof-of-principle
- 30 cm long, $\sim 1/3$ of full detector
- first physics program focusing on hypernuclei

A large-size TPC:

- full detector will provide larger acceptance
- design to be determined based on the physics cases
- high momentum resolution for recoils
- potential for a multi-purpose detector:
 - spectroscopy of hypernuclei
 - QFS knockout reactions
 - heavy-ion collisions, and more...
- **2023: design of full HYDRA and a TDR to FAIR**

